

969,581

## PATENT SPECIFICATION

DRAWINGS ATTACHED

969,581



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## COMPLETE SPECIFICATION

## Selection of Eggs for Incubation

We, S. SMITH & SONS (ENGLAND) LIMITED, a British Company of Cricklewood Works, London, N.W.2, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to the sorting of eggs suitable for incubation from those which are not.

When eggs are incubated artificially on a commercial scale there is a considerable wastage due to the presence of eggs which do not produce chicks and after incubation are worthless. Considerable economics in incubator space could be effected and more efficient operation could be achieved if it were possible to detect such eggs before incubation and remove them for sale. Hereinafter we shall use the terms "active" and "inert" to distinguish eggs which are either developing or capable of developing into chicks from those which are not.

It has now been found that there is a difference between the thermal properties of active and inert eggs which enables them to be separated from one another. This difference becomes apparent if otherwise similar eggs are stored for a time at a slightly elevated temperature, say about 30°C, and are then allowed to cool in an atmosphere at a lower temperature of, say, 20°C.

The surface temperature of the active eggs falls more rapidly than that of the inert eggs and after a few minutes there is a detectable difference of surface temperature between them, which may, for example, be measured with an infra-red sensitive device. The difference can also be detected if the eggs are held in the hand, when, however, an active egg feels hotter after a short time than an inert egg.

The precise nature of the difference in thermal properties is obscure, and it may be that there is some difference in internal stratification, or thermal conductivity, or internal con-

vective heat transfer mechanism as between active and inert eggs. Investigation shows that there is no appreciable difference between the "bulk" specific heat of the material of active and inert eggs after they have been broken and the white and yolk mixed. The difference in thermal properties becomes apparent as a difference in surface temperature when an active and an inert egg are subjected to the same change in thermal conditions and this phenomenon is most easily explained as being due to a difference in the rate of heat transfer between the surface of the shell and the interior of the egg.

The present invention resides in the use of this difference of thermal properties between active and inert eggs to sort the one from the other.

In a method in accordance with the invention for separating active and inert eggs, the eggs are brought to thermal equilibrium at one ambient temperature, they are then subjected to a change in external thermal conditions, the resulting change of surface temperature of each egg is detected, and the active and inert eggs are separated in accordance with their different surface temperature changes.

A method of selecting active eggs from a number of eggs of unknown condition in accordance with the invention, comprises the steps of bringing the eggs to a uniform first temperature, exposing the eggs to a uniform ambient temperature different from the first temperature, measuring the surface temperatures of the individual eggs after a predetermined period of exposure to this different temperature, and separating those eggs whose surface temperature has diverged most widely from the first temperature.

In a preferred method of separating active eggs from a mixture of active and inert eggs the eggs are allowed to reach a stable condition at a first temperature and then exposed to an ambient temperature different from the first temperature for a predetermined time, the

[Price 4s. 6d.]

5 surface temperatures of the individual eggs are determined by a device responsive to the infra-red radiations from the eggs, and the eggs whose surface temperature has departed from the first temperature by more than a predetermined amount are separated from the others.

10 It will be understood that it is not necessary to determine the actual numerical value of the surface temperature since the characteristics of the infra-red radiation emitted provide a measure of this temperature.

15 By way of example, a method in accordance with the invention and apparatus for carrying out this method will now be described with reference to the accompanying schematic drawing.

20 The eggs are stored in a chamber 10 in which the temperature is maintained at 30°C. After storage for a time sufficient to establish stable and uniform temperature conditions the eggs 11 are taken from the storage chamber 10 and passed on a conveyor 12 under a scanning device 13 responsive to infra-red radiation from the surfaces of the eggs. The conveyor 12 and its surroundings are at normal room temperature of about 20°C and the speed of the conveyor is such that the eggs 11 pass under the scanner 10 to 15 minutes after leaving the store. After this period of exposure to a lower ambient temperature the surface temperatures of the active and inert eggs are detectably different.

30 The eggs on the conveyor 12 pass from the scanning device 13 to a sorting head 14 having a row of suction cups 15 for picking out selected eggs. The cups 15 are operated in dependence upon the response of the scanning device 13 through an automatic control circuit 16 incorporating an appropriate delay to lift the eggs with a lower apparent surface temperature onto a separate conveyor 17 for forwarding to the incubators. The remaining eggs, which are the inert ones, are transferred to another conveyor 18 and moved to a packing station.

45 The apparatus as described up to this point is completely automatic in operation. A switch 19 is provided to enable the apparatus to be changed over to manual control. A manual control device 20 can then be used by an operator to control the sorting head 14 in dependence upon a visual display of the output of the scanning device.

50 The conveyor 12 may be arranged to carry the eggs 11 through the store 10 at such a rate that they reach a stable, uniform, condition of thermal equilibrium before they leave the store and reach the scanning device only after an appropriate cooling period.

60 Preferably the conditions in the low temperature region are carefully controlled to ensure uniform conditions of cooling for all the eggs. The shells of the eggs should have similar emissive properties, the eggs being preferably all of the same genetic history, so that the

output of the infra-red scanning device can be correlated directly with the surface temperatures of the eggs. Changes from one kind of egg to another can be effected by appropriate calibration of the apparatus, for example by the use of combinations of infra-red filters.

70 The temperature of the storage chamber may be above or below the temperature to which the eggs are exposed while passing to the scanning head. While it is preferred to effect heating or cooling of the eggs by exchange of heat with the surrounding atmosphere other methods such as radiant heating are not excluded. The surface temperatures of the eggs may be determined by means of a probe placed in contact with the surface but this would appear to be less convenient than the use of the infra-red radiation from the surface. It might have the advantage of being less dependent on the surface properties of the egg once satisfactory thermal contact has been established.

80 It should be noted that for the most efficacious use of the present invention it is most desirable that differences between the eggs, apart from their active/inert condition, should be, as far as possible, eliminated. To this end, the eggs being examined in any one batch should be, as far as may be, uniform as to:—

- (a) age
- (b) size (or weight)
- (c) shell colour
- (d) shell thickness
- (e) genetic stock
- (f) feeding of the mother hen

100 Furthermore, the eggs in a given batch should all have been stored under conditions of the same humidity prior to the sorting process.

#### WHAT WE CLAIM IS:—

1. A method of separating active and inert eggs in which the eggs are brought to thermal equilibrium at a first ambient temperature, they are then subjected to a change in external thermal conditions, the resulting change of surface temperature of each egg is detected, and the active and inert eggs are separated in accordance with their different surface temperature changes.

115 2. A method of selecting active eggs from a number of eggs of unknown condition, comprising the steps of bringing the eggs to a uniform first temperature, exposing the eggs to a uniform ambient temperature different from the first temperature, measuring the surface temperatures of the individual eggs after a predetermined period of exposure to this different temperature, and separating those eggs whose surface temperature has diverged most widely from the first temperature.

125 3. A method as claimed in claim 1 or 2 in which the surface temperatures of the eggs

are measured by the infra-red radiation which they emit.

4. A method of separating active eggs from a mixture of active and inert eggs in which the eggs are allowed to reach a stable condition at a first temperature and then exposed to an ambient temperature different from the first temperature for a predetermined time, the surface temperatures of the individual eggs are determined by a device responsive to the infra-red radiation from the eggs, and the eggs whose surface temperature has departed from the first temperature by more than a predetermined amount are separated from the others.

5. A method as claimed in claim 3 or 4 in which the eggs are moved past a scanner responsive to the infra-red radiation from the surfaces of the eggs and then past a sorting head controlled by the scanner and having suction cups for lifting selected eggs.

6. A method as claimed in any one of claims 1 to 5 in which the first temperature is above the final temperature of the eggs.

7. A method as claimed in claim 6 in which the eggs are first heated and then allowed to cool.

8. A method as claimed in claim 7 in which the eggs are heated to a temperature not substantially higher than 30°C and then allowed to cool in an atmosphere at room temperature.

9. A method as claimed in claim 7 or 8 in which the eggs are heated to the first tem-

perature by passing them slowly through a heated zone.

10. Apparatus for carrying out the method of claim 1 or 2 including a store maintained at a first temperature, a conveyor for moving eggs from the store into a region at a second temperature, a sensing device for detecting the surface temperatures of the individual eggs after they have been in the said region for a predetermined period, and a selector for separating the eggs in accordance with the indications of the sensing device.

11. Apparatus as claimed in claim 10 in which the sensing device is sensitive to infra-red radiation from the surfaces of the shells of the eggs.

12. Apparatus as claimed in claim 10 or 11 in which the selector has suction cups for lifting selected eggs from the conveyor.

13. Apparatus as claimed in claim 10, 11 or 12 in which the conveyor is arranged to transport the eggs through the store.

14. Apparatus as claimed in any one of claims 10 to 13 including means for manually controlling the selector in dependence upon the indications of the sensing device.

15. Apparatus for sorting eggs substantially as described with reference to the accompanying drawing.

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COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of  
the Original on a reduced scale

